Strategies for Energy Efficient Remodeling

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Strategies for Energy Efficient Remodeling (SEER)

- Develop strategies for energy efficient remodeling for a specific location
- Identify major factors that serve as a basis for EE remodeling
- Evaluate performance and costs
- Initiate a community scale project

Existing Residential Buildings Program

The ERBP is based on use of a team-based systems research approach, including use of systems engineering and operations research techniques, to provide opportunities for cost and performance trade-offs that ***improve whole building performance and value while minimizing increases in overall building retrofit costs****. Use of a systems approach will also create process innovations that improve efficiency and flexibility of housing retrofit and* ***increase control over component interactions that improve house efficiency and performance****. Use of a systems approach will accelerate adoption of new technologies by increasing integration between the design and retrofit construction process, increasing system performance, increasing system cost effectiveness, and increasing system reliability and durability. Evaluation of advanced system concepts in* ***partnership with contractors, homeowners and state and local governments****, will provide* ***opportunities for early adopters and industry leaders to directly contribute*** *to key results from the research program. (DOE Building America Program)*

Field Research
NJ Remodel Site

Asdal Construction - Site located near Califon, NJ – gut remodel

Why EE Remodeling?

- Comfort
- Durability
- Environmental Performance
- Savings
- Extended life of the home

Summary of Process NJ Remodel Site

1. Project review performed
   - Climate, geography, incentives
2. Site evaluation performed
   - Building shell, HVAC system, ventilation
   - Basic simulations to estimate savings
3. EE strategy set recommended
4. Manufacturers/Installers identified
5. Installation monitoring
6. Performance monitoring (TBD)

Strategy Set – NJ Site

- Dense-pack insulation material
- Insulated siding
- Air sealing package
- Ground source HP
- Ducts in conditioned space
- Structural foam panel system for addition
- Manifold plumbing
- Solar hot water preheat
- Demand water heater backup
- EE lighting
- Single-point “smart” ventilation
- Solar electric (PV and Wind) systems

Summary of Major Factors in EE Remodeling (NJ Site)

- Rural site with high water table
  - Advantageous for ground source and solar
- Large incentives for solar PV
  - Solar thermal system easy add-on
- Large incentives for wind system
- High cost of utilities (electric and propane)
- Information available
  - Technologies, design aids, value
- Process to incorporate information

Next Steps

- SEER Team members to evaluate the strategies
  - Remodelers
  - Manufacturers
- Complete remodel and monitor
- Catalogue EE strategy set for builders
- Outline Process and Resources
- Community scale project site evaluation
- Develop training materials
- Information dissemination

Energy Use and Economic Summary

- Existing Home
  - Minimal remodeling, no energy measures
  - Theoretical only for this home
- Base Home
  - Original gut-rehab
  - Includes framed addition
- SEER remodel
  - With all final EE measures included
  - Estimates of appliance and plug loads

EE Measure Cost Estimates

Table 2 – EE Cost Summary

Technology	Base Retrofit	SEER Retrofit	Net Cost or Savings
Wall Insulation- Cavity	$ 1,456[1]	$ 2,900	$ 1,444
Wall Insulation- Continuous (w/ Siding)	$ 2,848[2]	$ 3,656	$ 808
Ceiling Insulation	$ 375	$ 672	$ 297
Floor Insulation	$ 470	$ 798	$ 328
Windows	$ 2,420	$ 2,820	$ 400
Air Sealing	$ 0	$ 500	$ 500
HVAC System	$ 9,100	$ 12,900	$ 3,800 (inc. $600 for excavation)
Water Heating System	$ 700	$ 4,400	$ 3,700
Water Distribution System	$ 2,700	$ 2,200	$ -500
Lighting (bulbs only)	$ 11	$ 23	$ 12
Fixed Appliances	$ 1,630	$ 1,950	$ 320
Addition Framing and Insulation	$ 3,000	$ 5,700	$ 2,700
Solar Electric System (PV)	$ 0	$ 15,120	$ 15,120
Total with PV[3]	23,080	52,009	28,929
Total without PV[3]	23,080	36,889	13,809

[1]Includes $733 for sheathing removal and disposal and $723 for R-13 batt insulation.
[2]Costs for uninsulated vinyl siding were used here to provide an accurate comparison.
[3]Without added cost for new minimum-efficiency appliances.

Energy and Cost Savings

Table 3 – Summary of SEER Case Study Energy Use and Costs/Savings

Performance Characteristic	**Before** Retrofit	**Base** Retrofit	Base Savings Over Before	**SEER** Energy Efficient Retrofit	SEER Savings Over Base	SEER Savings Over Before
Heating Peak Load (Btuh)	65,400	45,400	31%	15,900	65%	76%
Cooling Peak Load (Btuh)	0	26,400	--	13,400	49%	--
Annual Heating Load	134.3	71.0	47%	24.3	66%	82%
Annual Cooling Load	0.0	12.7	--	10.9	14%	--
Totals (Million Btu)	134.3	83.8	38%	33.2	60%	75%
Heating Cost[2]	$2,660	$1,794	33%	$179	90%	93%
Cooling Cost	$0.0	$163	--	$61	--	--
Total Heating and Cooling Costs	$2,660	$1,957	26%	$240	88%	91%
Water Heating Use (Million Btu)	30.5	27.4	10%	5.6	80%	82%
Appliance/Lighting Use (Million Btu)	19.6	19.6	0%	13.3	32%	32%
Water Heating Cost- Oil/Propane/Elect	$364/O	$556/P	-53%	$193/E	65%	47%
Appliances/Plug Loads	$672	$682	-1%	$455	33%	32%
Estimated Annual Energy Costs	$3,696	$3,195		$888		
Solar PV System (kWh)	0	0	--	8,899	--	--
Value of kWh @ utility rates ($)	$0	$0		$1,043		
Total Estimated Annual Energy Costs[3]	$3,756	$3,304	13.7%	$-95($0)[4]	103%	103%
HERS Score	39.3	77.6	49%	93.1		

Economic Analysis

Summary of Economic Analysis Based on Energy Value Only

Cost to add Base EE features to the Existing home remodel	$23,080
Annual Energy Savings (including the addition of A/C)	$501
Annual Energy Savings (with out the addition of A/C)	$664
From existing-to-Base (w/ A/C) Retrofit - Simple payback	46 years
From existing-to-Base (w/o A/C) Retrofit - Simple payback	35 years
Return-On-Investment (w/ A/C)	2.2%
Return-On-Investment (w/o A/C)	2.9%
Cost to add SEER EE features to the Existing home remodel (w/o PV)	$36,889
Annual Energy Savings	$2,808
From Existing-to-SEER Retrofit - Simple payback	13 years
Return-On-Investment	7.6%
Cost to add SEER features to the Base home remodel (w/o PV)	$13,809
Annual Energy Savings	$2,307
From Base-to-SEER Retrofit - Simple payback	6 years
Return-On-Investment	16.7%
Cost to add SEER EE features to the Existing home remodel (w/ PV)	$52,009
Annual Energy Savings	$3,696
From Existing-to-SEER Retrofit - Simple payback	14 years
Return-On-Investment	7.1%
Cost to add SEER features to the Base home remodel (w/ PV)	$28,929
Annual Energy Savings	$3,195
From Base-to-SEER Retrofit - Simple payback	9 years
Return-On-Investment	11.0%
Loan Payment – SEER and PV system (7%, 15 years, $28,929)	$260.02
Monthly utility savings ($3,195 annual cost)	$266.25

For More Information

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